

HIGHLY AVAILABLE AND SECURE NETWORK INFRASTRUCTURE DEVELOPMENT AND IMPLEMENTATION IN DEVELOPING COUNTRIES

**Adnan Strojil
IPI d.o.o Zenica
Fakultetska 1, 72000 Zenica
Bosnia and Herzegovina**

**Adnan Selimagić
IPI d.o.o. Zenica
Fakultetska 1, 72000 Zenica
Bosnia and Herzegovina**

ABSTRACT

Developing countries have issues with different problems in communication area trying to achieve high standards to cope with high availability requests of strict international standards such as ISO and IEEE. This paper explains possible solutions for highly available Virtual Private Networks (VPN) dealing with both authentication and privacy in environment of undeveloped public infrastructure and using all possible low cost technologies and all kinds of software solutions. It also underlines differences in engineering processes in developing countries and developed countries (key difference is workforce price). As a proof of thesis we presented in this paper, it shows an example of Federal Ministry of Transport and Communications of Bosnia and Herzegovina, which implemented a/TEST, integral informational system for MOT stations that use this type of network infrastructure.

Keywords: Network, Open Source, VPN, high availability, encryption, IPsec, OpenVPN

1. INTRODUCTION

With the aim of technical support for each process caused by human activity, mankind is always forced to utilize its science achievements in order to keep the balance between requirements and possible technical solutions. In modern time communication is one of the most important factors in building such support. Question is how to make that communication more reliable, secure, highly available, and accessible in right time? Using digital technology that problem is easy to solve, especially if regular Internet technology is used, as long as money for its implementation is available. For such solution we require following very important resources:

- Modern and enough fast network infrastructure, mostly implemented on Internet base, which "modernist" depends from country to country and its economy development;
- Modern and in most cases expensive cryptography equipment implemented as a routers with expensive outsourced support.

In case that we have a need to realize a secure, reliable, highly-available network and in case we are supported by resources accessible in developing country which is in lack of resources specified above, we need to find smarter way to implement it. This paper explains one of possible concepts for solving such a problem.

2. PROBLEM DEFINITION

As it was presented in last paragraph, we have two main resources in order to solve our problem: infrastructure and equipment. Both of them are not easy to be implemented in developing country, mostly because of its price. What is the solution?

2.1 Infrastructure problems

Developing countries are facing the infrastructure problems not only in communication sector, then in any other, logistics way. That results with more obstacles in process of implementation such a network: transportation problems, power supply problems, accessibility to remote locations...

2.2 Equipment problems

It is well known that for such resources it is easy to find hardware from different vendors that can support our needs. But, we are facing another two issues:

- Price (that price is mostly not affordable for developing countries)
- Support of such solutions, which is very expensive and adjusted for US or EU countries.

3. AVAILABLE RESOURCES AND KEY DIFFERENCE BETWEEN DEVELOPING AND DEVELOPED COUNTRIES RESOURCES

In order to solve an issue that we have to deal with, it is very important to understand differences between developing and developed countries. We need to notice our competitive advantage and use it in proper manner.

3.1 Price of engineer per hour in IT business

As a very important fact we need to notice that prices of developers working on solution are not the same all over the world. Developing countries need to use that benefit.

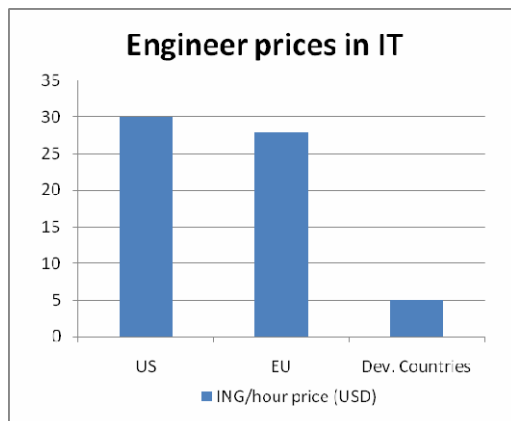


Figure 1. Price of the engineer force different parts of the World

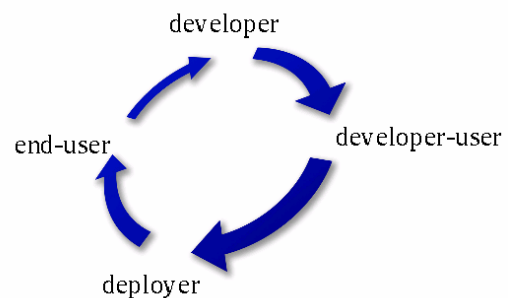


Figure 2. Principle of open source in development lifecycles

3.2 Open source software resources

Another important benefit is the open source resources and part of software that is already made. Basically, it only needs to be customized and tested in specific environment.

4. HARDWARE PLATFORM

Issuing with such a problems, for a VPN solutions it is very important to define hardware that would support such requirements. It is very important to find a solution for the client and server side and that that solution can be reliable enough, and that price would need to be acceptable for end user.

4.1 Server side - concentrator

Server side for the IPsec concentrator at first must be reliable, highly available and reliable enough. Most of the final solutions of different vendors are very strict about resources, software and hardware. What can be done when we have only commodity class of hardware available? Hardware can easily upgrade its reliability if it is realized as a redundant system. If our platform is commodity class PC, we can easily duplicate it for small price.

Next question would be redundancy protocol, and operating system that would route and crypt our packets. Solution can be found in open source software resources, such as pfSense, well known as a free solution for PC based routers.

At the bottom line we are facing following benefits:

- Cheap hardware realization
- Highly available system (redundancy can be implemented on many levels)
- Easy to configure
- System is completely scalable
- Available detailed statistics about traffic

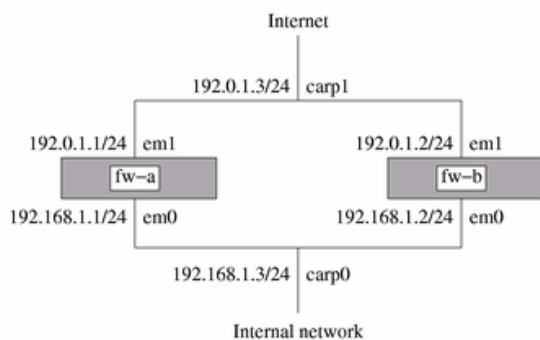


Figure 3. Concept of redundancy protocol for PC based routers.

Figure 4. Screenshot of the pfSense web configurator for IPsec concentrator.

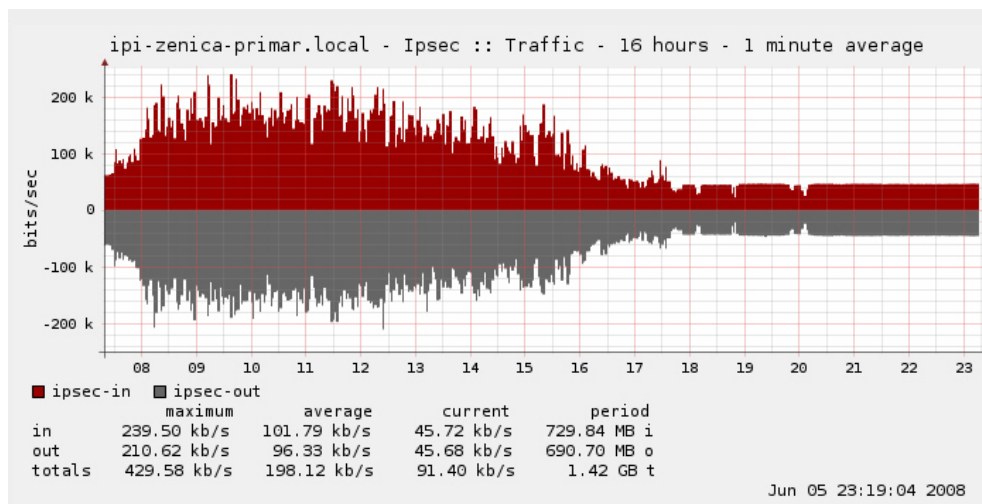


Figure 5. Screenshot of the pfSense traffic tunneling statistics in implementation in IPI Zenica for integral information system

4.2 Client side

Client side can be realized in different ways. The best implementation of such clients is hardware client. Most of today's soho routers are stable enough by hardware, but in most cases their software IOS-es make the final implementation problems. What we can do about that? We can search for a hardware that is opened enough for customization, and being capable of realizing an IPsec tunnel.

One of possible solutions is WRT54GL router which is famous by its openness and possibility to easily be adapted to any task. It is very important that today on the market are great variations of this router architecture, which draws a conclusion that support of this low cost router will be available in long future.

OpenWRT project allows to engineer to use his knowledge in customization, implementing IPsec tunnel which is required for secure communication. Adaptation of such router IOS requires some more additional activities:

- More engineering time for customization;
- More hardware optimization



Figure 6. Hardware overview of WRT54GL router

In case that user requires IPsec soft client, it can easily be installed from any of open source soft clients, which is already adapted for such a solution.

5. CONCLUSION

Implementation of highly available and secure network infrastructure in developing countries should never be an obstacle supporting other system in project integration. Even if there is lack of financial resources, it should never been understood as an impossible implementation.

It is very important that TCO (total cost of ownership) of any solution should not be always limited to the direct solution price, than to the maintenance and process of development. High prices of some very famous VPN solutions are caused by packed marketing and expensive developers and testing engineers. Software is not a resource that must be produced on a much specified place and be limited to possible upgrades. That is main benefit that engineers of developing countries need to understand in order to achieve their goals.

By this paper we are not attempting to marginalize commercial VPN solutions. This paper only specifies possible solutions in environments where financial resources are in great lack, but local knowledge of the local, mostly, unused engineers might be a resource that is very usable, and compensate it in any possible way.

6. REFERENCES

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